

## 1 CLAIMS

2 What is claimed is:

- 3 1. An optical device, comprising:  
4 a transmission optical waveguide; and  
5 an optical device component transverse-coupled to the transmission optical waveguide so as  
6 to enable optical signal power transfer therebetween,  
7 the transmission optical waveguide being adapted for at least one of receiving optical signal  
8 power from an optical signal transmission system and transmitting optical signal power  
9 to the optical signal transmission system,  
10 the optical device component including a laterally-confined multi-layer dispersion-  
11 engineered waveguide structure, the multi-layer waveguide structure including at least  
12 one multi-layer reflector stack,  
13 the optical device component being transverse-coupled to the transmission optical  
14 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
15 being adapted for enabling modal-index-matching between the transmission optical  
16 waveguide and the optical device component.
- 17 2. The optical device of Claim 1, the transmission optical waveguide being a low-index optical  
18 waveguide.
- 19 3. The optical device of Claim 2, the transmission optical waveguide being a fiber-optic  
20 transmission waveguide, the fiber-optic transmission waveguide being adapted for  
21 transverse-coupling with the optical device component.
- 22 4. The optical device of Claim 3, the transmission fiber-optic waveguide being adapted for at  
23 least one of receiving optical signal power from a fiber-optic telecommunications system  
24 and transmitting optical signal power to a fiber-optic telecommunications system.
- 25 5. An optical device, comprising:  
26 a transmission optical waveguide; and  
27 an optical device component transverse-coupled to the transmission optical waveguide so as  
28 to enable optical signal power transfer therebetween,

1 the transmission optical waveguide being adapted for at least one of receiving optical signal  
2 power from an optical signal transmission system and transmitting optical signal power  
3 to the optical signal transmission system,

4 the optical device component including a laterally-confined multi-layer dispersion-  
5 engineered waveguide structure, the multi-layer waveguide structure including at least  
6 one multi-layer reflector stack,

7 the optical device component being transverse-coupled to the transmission optical  
8 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
9 being adapted for enabling modal-index-matching between the transmission optical  
10 waveguide and the optical device component,

11 the transmission fiber-optic waveguide including a fiber-optic-taper segment, the fiber-  
12 optic-taper segment being transverse-coupled to the optical device component.

13 6. An optical device, comprising:

14 a transmission optical waveguide; and

15 an optical device component transverse-coupled to the transmission optical waveguide so as  
16 to enable optical signal power transfer therebetween,

17 the transmission optical waveguide being adapted for at least one of receiving optical signal  
18 power from an optical signal transmission system and transmitting optical signal power  
19 to the optical signal transmission system,

20 the optical device component including a laterally-confined multi-layer dispersion-  
21 engineered waveguide structure, the multi-layer waveguide structure including at least  
22 one multi-layer reflector stack,

23 the optical device component being transverse-coupled to the transmission optical  
24 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
25 being adapted for enabling modal-index-matching between the transmission optical  
26 waveguide and the optical device component,

27 the transmission optical waveguide being a low-index planar lightwave transmission optical  
28 waveguide.

29 7. An optical device, comprising:

30 a transmission optical waveguide; and

1 an optical device component transverse-coupled to the transmission optical waveguide so as  
2 to enable optical signal power transfer therebetween,  
3 the transmission optical waveguide being adapted for at least one of receiving optical signal  
4 power from an optical signal transmission system and transmitting optical signal power  
5 to the optical signal transmission system,  
6 the optical device component including a laterally-confined multi-layer dispersion-  
7 engineered waveguide structure, the multi-layer waveguide structure including at least  
8 one multi-layer reflector stack,  
9 the optical device component being transverse-coupled to the transmission optical  
10 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
11 being adapted for enabling modal-index-matching between the transmission optical  
12 waveguide and the optical device component,  
13 the multi-layer waveguide structure being adapted for passive modal-index-matching  
14 between the transmission optical waveguide and the multi-layer waveguide structure.

15 8. The optical device of Claim 7, the multi-layer waveguide structure including high-index  
16 material, the transmission optical waveguide being a low-index transmission optical  
17 waveguide.

18 9. An optical device, comprising:  
19 a transmission optical waveguide; and  
20 an optical device component transverse-coupled to the transmission optical waveguide so as  
21 to enable optical signal power transfer therebetween,  
22 the transmission optical waveguide being adapted for at least one of receiving optical signal  
23 power from an optical signal transmission system and transmitting optical signal power  
24 to the optical signal transmission system,  
25 the optical device component including a laterally-confined multi-layer dispersion-  
26 engineered waveguide structure, the multi-layer waveguide structure including at least  
27 one multi-layer reflector stack,  
28 the optical device component being transverse-coupled to the transmission optical  
29 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

1 being adapted for enabling modal-index-matching between the transmission optical  
2 waveguide and the optical device component,  
3 the multi-layer waveguide structure being adapted for passive modal-index-matching  
4 between the transmission optical waveguide and the multi-layer waveguide structure,  
5 the multi-layer waveguide including high-index material, the transmission optical  
6 waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper  
7 segment, the fiber-optic-taper segment being transverse-coupled to the multi-layer  
8 waveguide structure.

9 10. An optical device, comprising:

10 a transmission optical waveguide; and  
11 an optical device component transverse-coupled to the transmission optical waveguide so as  
12 to enable optical signal power transfer therebetween,  
13 the transmission optical waveguide being adapted for at least one of receiving optical signal  
14 power from an optical signal transmission system and transmitting optical signal power  
15 to the optical signal transmission system,  
16 the optical device component including a laterally-confined multi-layer dispersion-  
17 engineered waveguide structure, the multi-layer waveguide structure including at least  
18 one multi-layer reflector stack,  
19 the optical device component being transverse-coupled to the transmission optical  
20 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
21 being adapted for enabling modal-index-matching between the transmission optical  
22 waveguide and the optical device component,  
23 the multi-layer waveguide structure being adapted for passive modal-index-matching  
24 between the transmission optical waveguide and the multi-layer waveguide structure,  
25 the multi-layer waveguide structure including high-index material, the transmission optical  
26 waveguide being a low-index planar lightwave transmission optical waveguide.

27 11. An optical device, comprising:

28 a transmission optical waveguide; and  
29 an optical device component transverse-coupled to the transmission optical waveguide so as  
30 to enable optical signal power transfer therebetween,

1 the transmission optical waveguide being adapted for at least one of receiving optical signal  
 2 power from an optical signal transmission system and transmitting optical signal power  
 3 to the optical signal transmission system,  
 4 the optical device component including a laterally-confined multi-layer dispersion-  
 5 engineered waveguide structure, the multi-layer waveguide structure including at least  
 6 one multi-layer reflector stack,  
 7 the optical device component being transverse-coupled to the transmission optical  
 8 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
 9 being adapted for enabling modal-index-matching between the transmission optical  
 10 waveguide and the optical device component,  
 11 the multi-layer waveguide structure being adapted for passive modal-index-matching  
 12 between the transmission optical waveguide and the multi-layer waveguide structure,  
 13 the multi-layer waveguide structure being adapted for integration into an integrated optical  
 14 device, the multi-layer waveguide structure being adapted for substantially completely  
 15 transferring optical signal power between the transmission optical waveguide and the  
 16 multi-layer waveguide structure, the multi-layer waveguide structure being thereby  
 17 adapted to function as at least one of a passive input coupler and a passive output  
 18 coupler between the transmission optical waveguide and the integrated optical device.

19 12. An optical device, comprising:

20 a transmission optical waveguide; and  
 21 an optical device component transverse-coupled to the transmission optical waveguide so as  
 22 to enable optical signal power transfer therebetween,  
 23 the transmission optical waveguide being adapted for at least one of receiving optical signal  
 24 power from an optical signal transmission system and transmitting optical signal power  
 25 to the optical signal transmission system,  
 26 the optical device component including a laterally-confined multi-layer dispersion-  
 27 engineered waveguide structure, the multi-layer waveguide structure including at least  
 28 one multi-layer reflector stack,  
 29 the optical device component being transverse-coupled to the transmission optical  
 30 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

1 being adapted for enabling modal-index-matching between the transmission optical  
2 waveguide and the optical device component,  
3 the multi-layer waveguide structure including an active layer, the active layer including at  
4 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
5 waveguide structure being adapted so that varying a control signal applied to the active  
6 layer results in at least one of varying optical loss and varying modal-index for the  
7 multi-layer waveguide structure.

8 13. The optical device of Claim 12, the multi-layer waveguide structure including at least one  
9 electro-active layer, the electro-active layer including at least one of an electro-optic layer  
10 and an electro-absorptive layer, the multi-layer waveguide structure including a pair of  
11 electrical contact layers with the electro-active layer therebetween, the control signal being  
12 an electronic control signal applied through the electrical contact layers.

13 14. The optical device of Claim 12, the multi-layer waveguide structure including at least one  
14 non-linear-optical layer, the control signal being an optical control signal applied to the non-  
15 linear-optical layer.

16 15. The optical device of Claim 12, the multi-layer waveguide structure including high-index  
17 material, the transmission optical waveguide being a low-index transmission optical  
18 waveguide, the multi-layer waveguide structure being adapted for active modal-index-  
19 matching with the low-index transmission optical waveguide in response to the control  
20 signal.

21 16. An optical device, comprising:  
22 a transmission optical waveguide; and  
23 an optical device component transverse-coupled to the transmission optical waveguide so as  
24 to enable optical signal power transfer therebetween,  
25 the transmission optical waveguide being adapted for at least one of receiving optical signal  
26 power from an optical signal transmission system and transmitting optical signal power  
27 to the optical signal transmission system,

1 the optical device component including a laterally-confined multi-layer dispersion-  
2 engineered waveguide structure, the multi-layer waveguide structure including at least  
3 one multi-layer reflector stack,  
4 the optical device component being transverse-coupled to the transmission optical  
5 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
6 being adapted for enabling modal-index-matching between the transmission optical  
7 waveguide and the optical device component,  
8 the multi-layer waveguide structure including an active layer, the active layer including at  
9 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
10 waveguide structure being adapted so that varying a control signal applied to the active  
11 layer results in at least one of varying optical loss and varying modal-index for the  
12 multi-layer waveguide structure,  
13 the multi-layer waveguide including high-index material, the transmission optical  
14 waveguide being a transmission fiber-optic waveguide including a fiber-optic-taper  
15 segment, the fiber-optic-taper segment being transverse-coupled to the multi-layer  
16 waveguide structure, the multi-layer waveguide structure being adapted for active  
17 modal-index-matching with the fiber-optic-taper segment in response to the control  
18 signal.

19 17. An optical device, comprising:  
20 a transmission optical waveguide; and  
21 an optical device component transverse-coupled to the transmission optical waveguide so as  
22 to enable optical signal power transfer therebetween,  
23 the transmission optical waveguide being adapted for at least one of receiving optical signal  
24 power from an optical signal transmission system and transmitting optical signal power  
25 to the optical signal transmission system,  
26 the optical device component including a laterally-confined multi-layer dispersion-  
27 engineered waveguide structure, the multi-layer waveguide structure including at least  
28 one multi-layer reflector stack,  
29 the optical device component being transverse-coupled to the transmission optical  
30 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

1 being adapted for enabling modal-index-matching between the transmission optical  
2 waveguide and the optical device component,  
3 the multi-layer waveguide structure including an active layer, the active layer including at  
4 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
5 waveguide structure being adapted so that varying a control signal applied to the active  
6 layer results in at least one of varying optical loss and varying modal-index for the  
7 multi-layer waveguide structure,  
8 the multi-layer waveguide structure including high-index material, the transmission optical  
9 waveguide being a low-index planar lightwave transmission optical waveguide, the  
10 multi-layer waveguide structure being adapted for active modal-index-matching with  
11 the low-index planar lightwave transmission optical waveguide in response to the  
12 control signal.

13 18. An optical device, comprising:

14 a transmission optical waveguide; and

15 an optical device component transverse-coupled to the transmission optical waveguide so as  
16 to enable optical signal power transfer therebetween,

17 the transmission optical waveguide being adapted for at least one of receiving optical signal  
18 power from an optical signal transmission system and transmitting optical signal power  
19 to the optical signal transmission system,

20 the optical device component including a laterally-confined multi-layer dispersion-  
21 engineered waveguide structure, the multi-layer waveguide structure including at least  
22 one multi-layer reflector stack,

23 the optical device component being transverse-coupled to the transmission optical  
24 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
25 being adapted for enabling modal-index-matching between the transmission optical  
26 waveguide and the optical device component,

27 the multi-layer waveguide structure including an active layer, the active layer including at  
28 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
29 waveguide structure being adapted so that varying a control signal applied to the active

1 layer results in at least one of varying optical loss and varying modal-index for the  
2 multi-layer waveguide structure,  
3 the multi-layer waveguide structure being adapted for integration into an integrated optical  
4 device, the multi-layer waveguide structure being adapted for substantially modal-  
5 index-matching with the transmission optical waveguide in response to the control  
6 signal so as to substantially completely transfer optical signal power between the  
7 transmission optical waveguide and the multi-layer waveguide structure in response to  
8 the control signal, the multi-layer waveguide structure being thereby adapted for  
9 functioning as at least one of an active input coupler and an active output coupler  
10 between the transmission optical waveguide and the integrated optical device.

11 19. An optical device, comprising:

12 a transmission optical waveguide; and  
13 an optical device component transverse-coupled to the transmission optical waveguide so as  
14 to enable optical signal power transfer therebetween,  
15 the transmission optical waveguide being adapted for at least one of receiving optical signal  
16 power from an optical signal transmission system and transmitting optical signal power  
17 to the optical signal transmission system,  
18 the optical device component including a laterally-confined multi-layer dispersion-  
19 engineered waveguide structure, the multi-layer waveguide structure including at least  
20 one multi-layer reflector stack,  
21 the optical device component being transverse-coupled to the transmission optical  
22 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
23 being adapted for enabling modal-index-matching between the transmission optical  
24 waveguide and the optical device component,  
25 the multi-layer waveguide structure including an active layer, the active layer including at  
26 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
27 waveguide structure being adapted so that varying a control signal applied to the active  
28 layer results in at least one of varying optical loss and varying modal-index for the  
29 multi-layer waveguide structure,

1 the multi-layer waveguide structure being adapted for substantially completely transferring  
2 optical signal power between the transmission optical waveguide and the multi-layer  
3 waveguide structure in response to a first control signal level, the multi-layer waveguide  
4 structure being adapted for substantially preventing optical signal power transfer  
5 between the transmission optical waveguide and the multi-layer waveguide structure in  
6 response to a second control signal level, the optical device being thereby adapted for  
7 functioning as an optical switch.

8 20. An optical device, comprising:

9 a transmission optical waveguide; and

10 an optical device component transverse-coupled to the transmission optical waveguide so as  
11 to enable optical signal power transfer therebetween,

12 the transmission optical waveguide being adapted for at least one of receiving optical signal  
13 power from an optical signal transmission system and transmitting optical signal power  
14 to the optical signal transmission system,

15 the optical device component including a laterally-confined multi-layer dispersion-  
16 engineered waveguide structure, the multi-layer waveguide structure including at least  
17 one multi-layer reflector stack,

18 the optical device component being transverse-coupled to the transmission optical  
19 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
20 being adapted for enabling modal-index-matching between the transmission optical  
21 waveguide and the optical device component,

22 the multi-layer waveguide structure including an active layer, the active layer including at  
23 least one of an electro-active layer and a non-linear-optical layer, the multi-layer  
24 waveguide structure being adapted so that varying a control signal applied to the active  
25 layer results in at least one of varying optical loss and varying modal-index for the  
26 multi-layer waveguide structure,

27 the multi-layer waveguide structure being adapted for allowing substantially maximal  
28 transmission of optical signal power through the transmission optical waveguide in  
29 response to a first control signal level, the multi-layer waveguide structure being  
30 adapted allowing substantially minimal transmission of optical signal power through the

1 transmission optical waveguide in response to a second control signal level, the multi-  
2 layer waveguide structure being adapted for allowing an intermediate transmission level  
3 of optical signal power through the transmission optical waveguide in response to an  
4 intermediate control signal level, the optical device being thereby adapted for  
5 functioning as at least one of an optical modulator and a variable optical attenuator.

6 21. The optical device of Claim 20, the multi-layer waveguide structure being adapted for  
7 exhibiting varying modal-index in response to varying control signal level.

8 22. The optical device of Claim 20, the multi-layer waveguide structure being adapted for  
9 exhibiting varying optical loss in response to varying control signal level.

10 23. An optical device, comprising:

11 a transmission optical waveguide; and

12 an optical device component transverse-coupled to the transmission optical waveguide so as  
13 to enable optical signal power transfer therebetween,

14 the transmission optical waveguide being adapted for at least one of receiving optical signal  
15 power from an optical signal transmission system and transmitting optical signal power  
16 to the optical signal transmission system,

17 the optical device component including a laterally-confined multi-layer dispersion-  
18 engineered waveguide structure, the multi-layer waveguide structure including at least  
19 one multi-layer reflector stack,

20 the optical device component being transverse-coupled to the transmission optical

21 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
22 being adapted for enabling modal-index-matching between the transmission optical  
23 waveguide and the optical device component,

24 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer  
25 waveguide structure being substantially parallel to the substrate.

26 24. The optical device of Claim 23, the multi-layer reflector stack comprising a distributed  
27 Bragg reflector stack.

28 25. The optical device of Claim 23, the multi-layer waveguide structure being fabricated at least  
29 in part by deposition of layers on the substrate.

- 1 26. The optical device of Claim 23, the multi-layer waveguide structure including a single  
2 multi-layer reflector stack, the multi-layer waveguide structure being thereby adapted for  
3 guiding a surface-guided optical mode.
- 4 27. The optical device of Claim 23, the multi-layer waveguide structure including two multi-  
5 layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure  
6 being thereby adapted for guiding an optical mode along the core layer.
- 7 28. An optical device, comprising:  
8 a transmission optical waveguide; and  
9 an optical device component transverse-coupled to the transmission optical waveguide so as  
10 to enable optical signal power transfer therebetween,  
11 the transmission optical waveguide being adapted for at least one of receiving optical signal  
12 power from an optical signal transmission system and transmitting optical signal power  
13 to the optical signal transmission system,  
14 the optical device component including a laterally-confined multi-layer dispersion-  
15 engineered waveguide structure, the multi-layer waveguide structure including at least  
16 one multi-layer reflector stack,  
17 the optical device component being transverse-coupled to the transmission optical  
18 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
19 being adapted for enabling modal-index-matching between the transmission optical  
20 waveguide and the optical device component,  
21 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer  
22 waveguide structure being substantially parallel to the substrate,  
23 the multi-layer waveguide structure including a ridge-like waveguide structure protruding  
24 from the substrate formed by spatially-selective removal of material of lateral portions  
25 of the multi-layer waveguide structure.
- 26 29. The optical device of Claim 28, the material being removed substantially completely down  
27 to the substrate.
- 28 30. The optical device of Claim 28, the material being only partially removed.

- 1 31. The optical device of Claim 28, the material being removed substantially symmetrically  
2 from lateral portions of the multi-layer waveguide structure.
- 3 32. The optical device of Claim 28, the material being removed asymmetrically from lateral  
4 portions of the multi-layer waveguide structure.
- 5 33. The optical device of Claim 28, the transmission optical waveguide being transverse-  
6 coupled at a side surface of the multi-layer waveguide structure.
- 7 34. The optical device of Claim 28, the transmission optical waveguide being transverse-  
8 coupled at a top surface of the multi-layer waveguide structure.
- 9 35. An optical device, comprising:  
10 a transmission optical waveguide; and  
11 an optical device component transverse-coupled to the transmission optical waveguide so as  
12 to enable optical signal power transfer therebetween,  
13 the transmission optical waveguide being adapted for at least one of receiving optical signal  
14 power from an optical signal transmission system and transmitting optical signal power  
15 to the optical signal transmission system,  
16 the optical device component including a laterally-confined multi-layer dispersion-  
17 engineered waveguide structure, the multi-layer waveguide structure including at least  
18 one multi-layer reflector stack,  
19 the optical device component being transverse-coupled to the transmission optical  
20 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
21 being adapted for enabling modal-index-matching between the transmission optical  
22 waveguide and the optical device component,  
23 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer  
24 waveguide structure being substantially parallel to the substrate,  
25 at least one layer of the multi-layer waveguide structure being provided with a lateral lower-  
26 index portion.
- 27 36. The optical device of Claim 35, the lateral lower-index portion being provided on only one  
28 side of the multi-layer waveguide structure.

1 37. The optical device of Claim 35, the lateral lower-index portion being provided on both sides  
2 of the multi-layer waveguide structure.

3 38. The optical device of Claim 35, the lateral lower-index portion being provided by physical  
4 modification of at least one lateral portion of at least one layer.

5 39. An optical device, comprising:

6 a transmission optical waveguide; and

7 an optical device component transverse-coupled to the transmission optical waveguide so as

8 to enable optical signal power transfer therebetween,

9 the transmission optical waveguide being adapted for at least one of receiving optical signal

10 power from an optical signal transmission system and transmitting optical signal power

11 to the optical signal transmission system,

12 the optical device component including a laterally-confined multi-layer dispersion-

13 engineered waveguide structure, the multi-layer waveguide structure including at least

14 one multi-layer reflector stack,

15 the optical device component being transverse-coupled to the transmission optical

16 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure

17 being adapted for enabling modal-index-matching between the transmission optical

18 waveguide and the optical device component,

19 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer

20 waveguide structure being substantially parallel to the substrate,

21 at least one layer of the multi-layer waveguide structure being provided with a lateral lower-

22 index portion,

23 the lateral lower-index portion being provided by deposition of lower-index material.

24 40. An optical device, comprising:

25 a transmission optical waveguide; and

26 an optical device component transverse-coupled to the transmission optical waveguide so as

27 to enable optical signal power transfer therebetween,

28 the transmission optical waveguide being adapted for at least one of receiving optical signal

29 power from an optical signal transmission system and transmitting optical signal power

30 to the optical signal transmission system,

1 the optical device component including a laterally-confined multi-layer dispersion-  
2 engineered waveguide structure, the multi-layer waveguide structure including at least  
3 one multi-layer reflector stack,  
4 the optical device component being transverse-coupled to the transmission optical  
5 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
6 being adapted for enabling modal-index-matching between the transmission optical  
7 waveguide and the optical device component,  
8 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer  
9 waveguide structure being substantially parallel to the substrate,  
10 at least one layer of the multi-layer waveguide structure being provided with a lateral lower-  
11 index portion,  
12 the lateral lower-index portion being provided by chemical modification of at least one  
13 lateral portion of at least one layer.

14 41. An optical device, comprising:

15 a transmission optical waveguide; and  
16 an optical device component transverse-coupled to the transmission optical waveguide so as  
17 to enable optical signal power transfer therebetween,  
18 the transmission optical waveguide being adapted for at least one of receiving optical signal  
19 power from an optical signal transmission system and transmitting optical signal power  
20 to the optical signal transmission system,  
21 the optical device component including a laterally-confined multi-layer dispersion-  
22 engineered waveguide structure, the multi-layer waveguide structure including at least  
23 one multi-layer reflector stack,  
24 the optical device component being transverse-coupled to the transmission optical  
25 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
26 being adapted for enabling modal-index-matching between the transmission optical  
27 waveguide and the optical device component,  
28 the multi-layer waveguide structure being positioned on a substrate, layers of the multi-layer  
29 waveguide structure being substantially perpendicular to the substrate.

- 1 42. The optical device of Claim 41, the multi-layer reflector stack comprising a distributed  
2 Bragg reflector stack.
- 3 43. The optical device of Claim 41, the multi-layer waveguide structure including two multi-  
4 layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure  
5 being thereby adapted for guiding an optical mode along the core layer.
- 6 44. The optical device of Claim 41, the multi-layer waveguide structure being formed by  
7 spatially-selective processing of waveguide material deposited on the substrate.
- 8 45. The optical device of Claim 41, the transmission optical waveguide being transverse-  
9 coupled to the multi-layer waveguide structure at a side surface thereof.
- 10 46. The optical device of Claim 41, the transmission optical waveguide being transverse-  
11 coupled to the multi-layer waveguide structure at a top surface thereof.
- 12 47. The optical device of Claim 1, lateral confinement being provided by at least one lateral  
13 grating provided in at least one layer.
- 14 48. The optical device of Claim 1, the multi-layer waveguide structure including at least one  
15 dielectric multi-layer reflector stack.
- 16 49. The optical device of Claim 1, the multi-layer waveguide structure including at least one  
17 semi-conductor layer.
- 18 50. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
19 higher-index GaAs and lower-index AlGaAs layers.
- 20 51. The optical device of Claim 50, at least one lower-index AlGaAs layer being provided with  
21 at least one lateral aluminum oxide portion.
- 22 52. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
23 higher-index AlGaAs and lower-index aluminum oxide layers.
- 24 53. The optical device of Claim 52, at least one higher-index AlGaAs layer being provided with  
25 at least one lateral aluminum oxide portion.
- 26 54. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
27 higher-index InP and lower-index InAlAs layers.

- 1 55. The optical device of Claim 54, at least one lower-index InAlAs layer being provided with  
2 at least one lateral aluminum oxide portion.
- 3 56. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
4 higher-index InAlAs and lower-index aluminum oxide layers.
- 5 57. The optical device of Claim 56, at least one higher-index InAlAs layer being provided with  
6 at least one lateral aluminum oxide portion.
- 7 58. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
8 higher-index InP and lower-index aluminum oxide layers.
- 9 59. The optical device of Claim 49, the multi-layer waveguide structure including alternating  
10 higher-index GaAs and lower-index aluminum oxide layers.
- 11 60. An optical device, comprising:  
12 a transmission optical waveguide; and  
13 an optical device component transverse-coupled to the transmission optical waveguide so as  
14 to enable optical signal power transfer therebetween,  
15 the transmission optical waveguide being adapted for at least one of receiving optical signal  
16 power from an optical signal transmission system and transmitting optical signal power  
17 to the optical signal transmission system,  
18 the optical device component including a laterally-confined multi-layer dispersion-  
19 engineered waveguide structure, the multi-layer waveguide structure including at least  
20 one multi-layer reflector stack,  
21 the optical device component being transverse-coupled to the transmission optical  
22 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
23 being adapted for enabling modal-index-matching between the transmission optical  
24 waveguide and the optical device component,  
25 the multi-layer waveguide structure including alternating higher-index semiconductor and  
26 lower-index semiconductor layers.
- 27 61. An optical device, comprising:  
28 a transmission optical waveguide; and

1 an optical device component transverse-coupled to the transmission optical waveguide so as  
2 to enable optical signal power transfer therebetween,  
3 the transmission optical waveguide being adapted for at least one of receiving optical signal  
4 power from an optical signal transmission system and transmitting optical signal power  
5 to the optical signal transmission system,  
6 the optical device component including a laterally-confined multi-layer dispersion-  
7 engineered waveguide structure, the multi-layer waveguide structure including at least  
8 one multi-layer reflector stack,  
9 the optical device component being transverse-coupled to the transmission optical  
10 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
11 being adapted for enabling modal-index-matching between the transmission optical  
12 waveguide and the optical device component,  
13 the multi-layer waveguide structure including alternating higher-index semiconductor and  
14 lower-index semiconductor layers,  
15 at least one of the higher-index semiconductor layers and the lower-index semi-conductor  
16 layers being provided with at least one lateral oxidized portion.

17 62. An optical device, comprising:

18 a transmission optical waveguide; and  
19 an optical device component transverse-coupled to the transmission optical waveguide so as  
20 to enable optical signal power transfer therebetween,  
21 the transmission optical waveguide being adapted for at least one of receiving optical signal  
22 power from an optical signal transmission system and transmitting optical signal power  
23 to the optical signal transmission system,  
24 the optical device component including a laterally-confined multi-layer dispersion-  
25 engineered waveguide structure, the multi-layer waveguide structure including at least  
26 one multi-layer reflector stack,  
27 the optical device component being transverse-coupled to the transmission optical  
28 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
29 being adapted for enabling modal-index-matching between the transmission optical  
30 waveguide and the optical device component,

1 the multi-layer waveguide structure including alternating higher-index semiconductor and  
2 lower-index oxide layers.

3 63. An optical device, comprising:

4 a transmission optical waveguide; and

5 an optical device component transverse-coupled to the transmission optical waveguide so as  
6 to enable optical signal power transfer therebetween,

7 the transmission optical waveguide being adapted for at least one of receiving optical signal  
8 power from an optical signal transmission system and transmitting optical signal power  
9 to the optical signal transmission system,

10 the optical device component including a laterally-confined multi-layer dispersion-  
11 engineered waveguide structure, the multi-layer waveguide structure including at least  
12 one multi-layer reflector stack,

13 the optical device component being transverse-coupled to the transmission optical  
14 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
15 being adapted for enabling modal-index-matching between the transmission optical  
16 waveguide and the optical device component,

17 the multi-layer waveguide structure including alternating higher-index semiconductor and  
18 lower-index oxide layers,

19 at least one higher-index semiconductor layer being provided with at least one lateral  
20 oxidized portion.

21 64. An optical device, comprising:

22 a transmission optical waveguide; and

23 an optical device component transverse-coupled to the transmission optical waveguide so as  
24 to enable optical signal power transfer therebetween,

25 the transmission optical waveguide being adapted for at least one of receiving optical signal  
26 power from an optical signal transmission system and transmitting optical signal power  
27 to the optical signal transmission system,

28 the optical device component including a laterally-confined multi-layer dispersion-  
29 engineered waveguide structure, the multi-layer waveguide structure including at least  
30 one multi-layer reflector stack,

1 the optical device component being transverse-coupled to the transmission optical  
2 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
3 being adapted for enabling modal-index-matching between the transmission optical  
4 waveguide and the optical device component,  
5 at least one layer of the multi-layer waveguide structure including an aluminum-containing  
6 semiconductor.

7 65. An optical device, comprising:

8 a transmission optical waveguide; and

9 an optical device component transverse-coupled to the transmission optical waveguide so as  
10 to enable optical signal power transfer therebetween,

11 the transmission optical waveguide being adapted for at least one of receiving optical signal  
12 power from an optical signal transmission system and transmitting optical signal power  
13 to the optical signal transmission system,

14 the optical device component including a laterally-confined multi-layer dispersion-  
15 engineered waveguide structure, the multi-layer waveguide structure including at least  
16 one multi-layer reflector stack,

17 the optical device component being transverse-coupled to the transmission optical  
18 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
19 being adapted for enabling modal-index-matching between the transmission optical  
20 waveguide and the optical device component,

21 at least one layer of the multi-layer waveguide structure being provided with at least one  
22 lateral aluminum oxide portion.

23 66. An optical device, comprising:

24 a transmission optical waveguide; and

25 an optical device component transverse-coupled to the transmission optical waveguide so as  
26 to enable optical signal power transfer therebetween,

27 the transmission optical waveguide being adapted for at least one of receiving optical signal  
28 power from an optical signal transmission system and transmitting optical signal power  
29 to the optical signal transmission system,

1 the optical device component including a laterally-confined multi-layer dispersion-  
2 engineered waveguide structure, the multi-layer waveguide structure including at least  
3 one multi-layer reflector stack,

4 the optical device component being transverse-coupled to the transmission optical  
5 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
6 being adapted for enabling modal-index-matching between the transmission optical  
7 waveguide and the optical device component,

8 the multi-layer waveguide structure including at least one semiconductor active layer.

9 67. The optical device of Claim 66, at least one semiconductor active layer being lattice-  
10 compatible with the multi-layer reflector stack.

11 68. The optical device of Claim 66, at least one semiconductor active layer being lattice-  
12 incompatible with the multi-layer reflector stack.

13 69. The optical device of Claim 66, at least one semiconductor active layer being an InGaAs  
14 layer.

15 70. The optical device of Claim 66, at least one semiconductor active layer being an InGaAsP  
16 layer.

17 71. The optical device of Claim 66, at least one semiconductor active layer being an InGaAsN  
18 layer.

19 72. An optical device, comprising:

20 a transmission optical waveguide; and

21 an optical device component transverse-coupled to the transmission optical waveguide so as  
22 to enable optical signal power transfer therebetween,

23 the transmission optical waveguide being adapted for at least one of receiving optical signal  
24 power from an optical signal transmission system and transmitting optical signal power  
25 to the optical signal transmission system,

26 the optical device component including a laterally-confined multi-layer dispersion-  
27 engineered waveguide structure, the multi-layer waveguide structure including at least  
28 one multi-layer reflector stack,

1 the optical device component being transverse-coupled to the transmission optical  
2 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
3 being adapted for enabling modal-index-matching between the transmission optical  
4 waveguide and the optical device component,  
5 the multi-layer waveguide structure including at least one semiconductor active layer,  
6 at least one semiconductor active layer being an electro-absorptive layer.

7 73. An optical device, comprising:

8 a transmission optical waveguide; and

9 an optical device component transverse-coupled to the transmission optical waveguide so as  
10 to enable optical signal power transfer therebetween,

11 the transmission optical waveguide being adapted for at least one of receiving optical signal  
12 power from an optical signal transmission system and transmitting optical signal power  
13 to the optical signal transmission system,

14 the optical device component including a laterally-confined multi-layer dispersion-  
15 engineered waveguide structure, the multi-layer waveguide structure including at least  
16 one multi-layer reflector stack,

17 the optical device component being transverse-coupled to the transmission optical  
18 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
19 being adapted for enabling modal-index-matching between the transmission optical  
20 waveguide and the optical device component,

21 the multi-layer waveguide structure including at least one semiconductor active layer,  
22 at least one semiconductor active layer being an electro-optic layer.

23 74. An optical device, comprising:

24 a transmission optical waveguide; and

25 an optical device component transverse-coupled to the transmission optical waveguide so as  
26 to enable optical signal power transfer therebetween,

27 the transmission optical waveguide being adapted for at least one of receiving optical signal  
28 power from an optical signal transmission system and transmitting optical signal power  
29 to the optical signal transmission system,

1 the optical device component including a laterally-confined multi-layer dispersion-  
2 engineered waveguide structure, the multi-layer waveguide structure including at least  
3 one multi-layer reflector stack,  
4 the optical device component being transverse-coupled to the transmission optical  
5 waveguide at the multi-layer waveguide structure, the multi-layer waveguide structure  
6 being adapted for enabling modal-index-matching between the transmission optical  
7 waveguide and the optical device component,  
8 the multi-layer waveguide structure including at least one semiconductor active layer,  
9 at least one semiconductor layer being a non-linear-optic layer.

10 75. An optical modulator, comprising:

11 an input optical waveguide;  
12 an output optical waveguide;  
13 a first intermediate optical waveguide connecting the input and output optical waveguides;  
14 and  
15 a second intermediate optical waveguide connecting the input and output optical  
16 waveguides,  
17 the input optical waveguide being adapted for receiving optical signal power from an optical  
18 signal transmission system, for dividing the received optical signal power into first and  
19 second optical signal power fractions, and for transmitting the first and second optical  
20 signal power fractions to the first and second intermediate optical waveguides,  
21 respectively,  
22 the output optical waveguide being adapted for receiving and recombining the first and  
23 second optical signal power fractions from the first and second intermediate optical  
24 waveguides, respectively,  
25 the output optical waveguide being adapted for substantially maximally transmitting the  
26 recombined optical signal power to the optical transmission system when the  
27 recombined first and second optical signal fractions substantially constructively  
28 interfere, and for substantially minimally transmitting the recombined optical signal  
29 power to the optical transmission system when the recombined first and second optical  
30 signal fractions substantially destructively interfere,

1 the input waveguide, output waveguide, first intermediate waveguide, and second  
2 intermediate waveguide each comprising a laterally-confined multi-layer dispersion-  
3 engineered waveguide structure, the multi-layer waveguide structure including at least  
4 one multi-layer reflector stack and at least one active layer, the active layer being  
5 adapted for exhibiting at least one of varying optical loss and varying modal-index in  
6 response to an applied control signal,  
7 at least one of the first and second intermediate waveguides being adapted for receiving the  
8 control signal,  
9 the multi-layer waveguide structure being adapted so that varying the control signal applied  
10 to at least one of the first and second intermediate waveguides results in a varying  
11 modal-index, thereby enabling control of interference between the recombined first and  
12 second optical signal power fractions at the output waveguide.

13 76. An optical modulator, comprising:

14 an input optical waveguide;  
15 an output optical waveguide;  
16 a first intermediate optical waveguide connecting the input and output optical waveguides;  
17 and  
18 a second intermediate optical waveguide connecting the input and output optical  
19 waveguides,

20 the input waveguide, output waveguide, first intermediate waveguide, and second  
21 intermediate waveguide each including a laterally-confined multi-layer dispersion-  
22 engineered waveguide structure, the multi-layer waveguide structure including at least  
23 one multi-layer reflector stack and at least one active layer, the active layer being  
24 adapted for exhibiting at least one of varying optical loss and varying modal-index in  
25 response to a varying applied control signal,  
26 at least one of the first and second intermediate waveguides being adapted for receiving the  
27 control signal,  
28 the input optical waveguide being adapted for receiving optical signal power from an optical  
29 signal transmission system, for dividing the received optical signal power into first and  
30 second optical signal power fractions, and for transmitting the first and second optical

1 signal power fractions to the first and second intermediate optical waveguides,  
2 respectively,  
3 the output optical waveguide being adapted for receiving and recombining the first and  
4 second optical signal power fractions from the first and second intermediate optical  
5 waveguides, respectively, and transmitting the recombined fractions to the optical signal  
6 transmission system,  
7 the optical modulator being thereby adapted so that varying the control signal level results in  
8 a varying level of transmission of the recombined fractions to the optical signal  
9 transmission system.

10 77. The optical modulator of Claim 76, the active layer including at least one electro-active  
11 layer, the electro-active layer including at least one of an electro-optic layer and an electro-  
12 absorptive layer, at least one of the intermediate waveguides including a pair of electrical  
13 contacts with the electro-active layer therebetween, the control signal being an electrical  
14 control signal applied through the electrical contacts.

15 78. The optical modulator of Claim 76, the active layer including at least one non-linear optical  
16 layer, the control signal being an optical control signal applied to a portion of the non-linear-  
17 optical layer in at least one of the intermediate waveguides.

18 79. The optical modulator of Claim 76, the multi-layer waveguide structure including a single  
19 multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for  
20 guiding a surface-guided optical mode.

21 80. The optical modulator of Claim 76, the multi-layer waveguide structure including two multi-  
22 layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure  
23 being thereby adapted for guiding an optical mode along the core layer.

24 81. The optical modulator of Claim 76, the input optical waveguide being adapted for receiving  
25 optical signal power from the optical signal transmission system by end-coupling, the output  
26 optical waveguide being adapted for transmitting optical signal power to the optical signal  
27 transmission system by end-coupling.

28 82. An optical modulator, comprising:  
29 an input optical waveguide;

1 an output optical waveguide;  
2 a first intermediate optical waveguide connecting the input and output optical waveguides;  
3 and  
4 a second intermediate optical waveguide connecting the input and output optical  
5 waveguides,  
6 the input waveguide, output waveguide, first intermediate waveguide, and second  
7 intermediate waveguide each including a laterally-confined multi-layer dispersion-  
8 engineered waveguide structure, the multi-layer waveguide structure including at least  
9 one multi-layer reflector stack and at least one active layer, the active layer being  
10 adapted for exhibiting at least one of varying optical loss and varying modal-index in  
11 response to a varying applied control signal,  
12 at least one of the first and second intermediate waveguides being adapted for receiving the  
13 control signal,  
14 the input optical waveguide being adapted for receiving optical signal power from an optical  
15 signal transmission system, for dividing the received optical signal power into first and  
16 second optical signal power fractions, and for transmitting the first and second optical  
17 signal power fractions to the first and second intermediate optical waveguides,  
18 respectively,  
19 the output optical waveguide being adapted for receiving and recombining the first and  
20 second optical signal power fractions from the first and second intermediate optical  
21 waveguides, respectively, and transmitting the recombined fractions to the optical signal  
22 transmission system,  
23 the optical modulator being thereby adapted so that varying the control signal level results in  
24 a varying level of transmission of the recombined fractions to the optical signal  
25 transmission system,  
26 the input optical waveguide being adapted for receiving optical signal power from the  
27 optical signal transmission system by transverse-coupling to a transmission optical  
28 waveguide, the output optical waveguide being adapted for transmitting optical signal  
29 power to the optical signal transmission system by transverse-coupling to a transmission  
30 optical waveguide.

1 83. The optical modulator of Claim 82, the multi-layer waveguide structure including a high-  
2 index material.

3 84. The optical modulator of Claim 82, the transmission optical waveguide being a low-index  
4 transmission optical waveguide, the low-index waveguide being adapted for transverse-  
5 coupling.

6 85. The optical modulator of Claim 82, the transmission optical waveguide being a transmission  
7 fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-  
8 coupling.

9 86. An optical modulator, comprising:

10 an input optical waveguide;

11 an output optical waveguide;

12 a first intermediate optical waveguide connecting the input and output optical waveguides;  
13 and

14 a second intermediate optical waveguide connecting the input and output optical  
15 waveguides,

16 the input waveguide, output waveguide, first intermediate waveguide, and second  
17 intermediate waveguide each including a laterally-confined multi-layer dispersion-  
18 engineered waveguide structure, the multi-layer waveguide structure including at least  
19 one multi-layer reflector stack and at least one active layer, the active layer being  
20 adapted for exhibiting at least one of varying optical loss and varying modal-index in  
21 response to a varying applied control signal,

22 at least one of the first and second intermediate waveguides being adapted for receiving the  
23 control signal,

24 the input optical waveguide being adapted for receiving optical signal power from an optical  
25 signal transmission system, for dividing the received optical signal power into first and  
26 second optical signal power fractions, and for transmitting the first and second optical  
27 signal power fractions to the first and second intermediate optical waveguides,  
28 respectively,

29 the output optical waveguide being adapted for receiving and recombining the first and  
30 second optical signal power fractions from the first and second intermediate optical

1 waveguides, respectively, and transmitting the recombined fractions to the optical signal  
2 transmission system,  
3 the optical modulator being thereby adapted so that varying the control signal level results in  
4 a varying level of transmission of the recombined fractions to the optical signal  
5 transmission system,  
6 the input optical waveguide being adapted for receiving optical signal power from the  
7 optical signal transmission system by transverse-coupling to a transmission optical  
8 waveguide, the output optical waveguide being adapted for transmitting optical signal  
9 power to the optical signal transmission system by transverse-coupling to a transmission  
10 optical waveguide,  
11 the transmission optical waveguide being a transmission fiber-optic waveguide including a  
12 fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-  
13 coupling.

14 87. An optical modulator, comprising:

15 an input optical waveguide;  
16 an output optical waveguide;  
17 a first intermediate optical waveguide connecting the input and output optical waveguides;  
18 and  
19 a second intermediate optical waveguide connecting the input and output optical  
20 waveguides,  
21 the input waveguide, output waveguide, first intermediate waveguide, and second  
22 intermediate waveguide each including a laterally-confined multi-layer dispersion-  
23 engineered waveguide structure, the multi-layer waveguide structure including at least  
24 one multi-layer reflector stack and at least one active layer, the active layer being  
25 adapted for exhibiting at least one of varying optical loss and varying modal-index in  
26 response to a varying applied control signal,  
27 at least one of the first and second intermediate waveguides being adapted for receiving the  
28 control signal,  
29 the input optical waveguide being adapted for receiving optical signal power from an optical  
30 signal transmission system, for dividing the received optical signal power into first and

1 second optical signal power fractions, and for transmitting the first and second optical  
2 signal power fractions to the first and second intermediate optical waveguides,  
3 respectively,  
4 the output optical waveguide being adapted for receiving and recombining the first and  
5 second optical signal power fractions from the first and second intermediate optical  
6 waveguides, respectively, and transmitting the recombined fractions to the optical signal  
7 transmission system,  
8 the optical modulator being thereby adapted so that varying the control signal level results in  
9 a varying level of transmission of the recombined fractions to the optical signal  
10 transmission system,  
11 the input optical waveguide being adapted for receiving optical signal power from the  
12 optical signal transmission system by transverse-coupling to a transmission optical  
13 waveguide, the output optical waveguide being adapted for transmitting optical signal  
14 power to the optical signal transmission system by transverse-coupling to a transmission  
15 optical waveguide,  
16 the transmission optical waveguide being a low-index planar lightwave transmission optical  
17 waveguide, the planar lightwave transmission optical waveguide being adapted for  
18 transverse-coupling.

19 88. An optical modulator, comprising:  
20 a transmission optical waveguide, the transmission optical waveguide including a first  
21 transverse-coupling segment, an intermediate segment, and a second transverse-  
22 coupling segment; and  
23 a modulator optical waveguide, the modulator optical waveguide including a first  
24 transverse-coupling segment, an intermediate segment, and a second transverse-  
25 coupling segment,  
26 the transmission optical waveguide and the modulator optical waveguide being transverse-  
27 coupled at the respective first transverse-coupling segments thereof,  
28 the transmission optical waveguide and the modulator optical waveguide being transverse-  
29 coupled at the respective second transverse-coupling segments thereof,

1 the transmission optical waveguide being adapted for receiving optical signal power from an  
2 optical signal transmission system into the first transverse-coupling segment thereof,  
3 the first transverse-coupling segment of the transmission optical waveguide and the first  
4 transverse-coupling segment of the modulator optical waveguide being adapted for  
5 dividing, via transverse optical coupling therebetween, the received optical signal power  
6 into a modulator waveguide fraction and a transmission waveguide fraction, and for  
7 transmitting the fractions to the respective intermediate waveguide segments,  
8 the second transverse-coupling segment of the transmission optical waveguide and the  
9 second transverse-coupling segment of the modulator optical waveguide being adapted  
10 for receiving and recombining, via transverse optical coupling, the modulator  
11 waveguide fraction and the transmission waveguide fraction,  
12 the second transverse-coupling segment of the transmission optical waveguide and the  
13 second transverse-coupling segment of the modulator optical waveguide being adapted  
14 for substantially maximally transmitting the recombined optical signal power to the  
15 optical signal transmission system when the recombined modulator waveguide fraction  
16 and transmission waveguide fraction substantially constructively interfere in the  
17 transmission optical waveguide, and for substantially minimally transmitting the  
18 recombined optical signal power to the optical signal transmission system when the  
19 recombined modulator waveguide fraction and transmission waveguide fraction  
20 substantially destructively interfere in the transmission optical waveguide,  
21 the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-  
22 engineered waveguide structure, the multi-layer structure including at least one multi-  
23 layer reflector stack and at least one active layer, the active layer being adapted for  
24 exhibiting at least one of varying optical loss and varying modal-index in response to an  
25 applied control signal,  
26 the multi-layer waveguide structure being adapted so that varying the control signal applied  
27 to the intermediate waveguide segment results in a varying modal-index, thereby  
28 enabling control of interference between the recombined modulator waveguide fraction  
29 and transmission waveguide fraction in the transmission optical waveguide.

30 89. An optical modulator, comprising:

1 a transmission optical waveguide, the transmission optical waveguide including a first  
2 transverse-coupling segment, an intermediate segment, and a second transverse-  
3 coupling segment; and  
4 a modulator optical waveguide, the modulator optical waveguide including a first  
5 transverse-coupling segment, an intermediate segment, and a second transverse-  
6 coupling segment,  
7 the transmission optical waveguide and the modulator optical waveguide being transverse-  
8 coupled at the respective first transverse-coupling segments thereof,  
9 the transmission optical waveguide and the modulator optical waveguide being transverse-  
10 coupled at the respective second transverse-coupling segments thereof,  
11 the transmission optical waveguide being adapted for receiving optical signal power from an  
12 optical signal transmission system into the first transverse-coupling segment thereof,  
13 the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-  
14 engineered waveguide structure, the multi-layer structure including at least one multi-  
15 layer reflector stack and at least one active layer, the active layer being adapted for  
16 exhibiting at least one of varying optical loss and varying modal-index in response to an  
17 applied control signal,  
18 the first transverse-coupling segment of the transmission optical waveguide and the first  
19 transverse-coupling segment of the modulator optical waveguide being adapted for  
20 dividing, via transverse optical coupling therebetween, the received optical signal power  
21 into a modulator waveguide fraction and a transmission waveguide fraction, and for  
22 transmitting the fractions to the respective intermediate waveguide segments,  
23 the second transverse-coupling segment of the transmission optical waveguide and the  
24 second transverse-coupling segment of the modulator optical waveguide being adapted  
25 for receiving, and recombining via transverse optical coupling the modulator waveguide  
26 fraction and the transmission waveguide fraction, and transmitting the recombined  
27 fractions to the optical signal transmission system,  
28 the multi-layer waveguide structure being adapted so that varying the control signal applied  
29 to the intermediate waveguide segment results in a varying level of transmission of the  
30 recombined fractions to the optical signal transmission system.

- 1 90. The optical modulator of Claim 89, the active layer including at least one electro-active  
2 layer, the electro-active layer including at least one of an electro-optic layer and an electro-  
3 absorptive layer, the intermediate segment of the modulator optical waveguide including a  
4 pair of electrical contacts with the electro-active layer therebetween, the control signal being  
5 an electrical control signal applied through the electrical contacts.
- 6 91. The optical modulator of Claim 89, the active layer including at least one non-linear optical  
7 layer, the control signal being an optical control signal applied to a portion of the non-linear-  
8 optical layer in the intermediate segment of the modulator optical waveguide.
- 9 92. The optical modulator of Claim 89, the multi-layer waveguide structure including a single  
10 multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for  
11 guiding a surface-guided optical mode.
- 12 93. The optical modulator of Claim 89, the multi-layer waveguide structure including two multi-  
13 layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure  
14 being thereby adapted for guiding an optical mode along the core layer.
- 15 94. The optical modulator of Claim 89, the first transverse-coupling segment of the transmission  
16 optical waveguide and the first transverse-coupling segment of the modulator optical  
17 waveguide being passively substantially modal-index-matched, the second transverse-  
18 coupling segment of the transmission optical waveguide and the second transverse-coupling  
19 segment of the modulator optical waveguide being passively substantially modal-index-  
20 matched.
- 21 95. The optical modulator of Claim 89, the first transverse-coupling segment of the transmission  
22 optical waveguide and the first transverse-coupling segment of the modulator optical  
23 waveguide being actively substantially modal-index-matched by applying an input control  
24 signal to the active layer in the first transverse-coupling segment of the modulator optical  
25 waveguide, the second transverse-coupling segment of the transmission optical waveguide  
26 and the second transverse-coupling segment of the modulator optical waveguide being  
27 actively substantially modal-index-matched by applying an output control signal to the  
28 active layer in the second transverse-coupling segment of the modulator optical waveguide.

- 1 96. The optical modulator of Claim 89, the multi-layer waveguide structure including a high-  
2 index material.
- 3 97. The optical modulator of Claim 89, the transmission optical waveguide being a low-index  
4 transmission optical waveguide, the low-index waveguide being adapted for transverse-  
5 coupling.
- 6 98. The optical modulator of Claim 89, the transmission optical waveguide being a transmission  
7 fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-  
8 coupling.
- 9 99. An optical modulator, comprising:  
10 a transmission optical waveguide, the transmission optical waveguide including a first  
11 transverse-coupling segment, an intermediate segment, and a second transverse-  
12 coupling segment; and  
13 a modulator optical waveguide, the modulator optical waveguide including a first  
14 transverse-coupling segment, an intermediate segment, and a second transverse-  
15 coupling segment,  
16 the transmission optical waveguide and the modulator optical waveguide being transverse-  
17 coupled at the respective first transverse-coupling segments thereof,  
18 the transmission optical waveguide and the modulator optical waveguide being transverse-  
19 coupled at the respective second transverse-coupling segments thereof,  
20 the transmission optical waveguide being adapted for receiving optical signal power from an  
21 optical signal transmission system into the first transverse-coupling segment thereof,  
22 the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-  
23 engineered waveguide structure, the multi-layer structure including at least one multi-  
24 layer reflector stack and at least one active layer, the active layer being adapted for  
25 exhibiting at least one of varying optical loss and varying modal-index in response to an  
26 applied control signal,  
27 the first transverse-coupling segment of the transmission optical waveguide and the first  
28 transverse-coupling segment of the modulator optical waveguide being adapted for  
29 dividing, via transverse optical coupling therebetween, the received optical signal power

1 into a modulator waveguide fraction and a transmission waveguide fraction, and for  
2 transmitting the fractions to the respective intermediate waveguide segments,  
3 the second transverse-coupling segment of the transmission optical waveguide and the  
4 second transverse-coupling segment of the modulator optical waveguide being adapted  
5 for receiving, and recombining via transverse optical coupling the modulator waveguide  
6 fraction and the transmission waveguide fraction, and transmitting the recombined  
7 fractions to the optical signal transmission system,  
8 the multi-layer waveguide structure being adapted so that varying the control signal applied  
9 to the intermediate waveguide segment results in a varying level of transmission of the  
10 recombined fractions to the optical signal transmission system,  
11 the transmission optical waveguide being a transmission fiber-optic waveguide including a  
12 fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-  
13 coupling.

14 100. An optical modulator, comprising:

15 a transmission optical waveguide, the transmission optical waveguide including a first  
16 transverse-coupling segment, an intermediate segment, and a second transverse-  
17 coupling segment; and  
18 a modulator optical waveguide, the modulator optical waveguide including a first  
19 transverse-coupling segment, an intermediate segment, and a second transverse-  
20 coupling segment,  
21 the transmission optical waveguide and the modulator optical waveguide being transverse-  
22 coupled at the respective first transverse-coupling segments thereof,  
23 the transmission optical waveguide and the modulator optical waveguide being transverse-  
24 coupled at the respective second transverse-coupling segments thereof,  
25 the transmission optical waveguide being adapted for receiving optical signal power from an  
26 optical signal transmission system into the first transverse-coupling segment thereof,  
27 the modulator optical waveguide comprising a laterally-confined multi-layer dispersion-  
28 engineered waveguide structure, the multi-layer structure including at least one multi-  
29 layer reflector stack and at least one active layer, the active layer being adapted for

1 exhibiting at least one of varying optical loss and varying modal-index in response to an  
2 applied control signal,  
3 the first transverse-coupling segment of the transmission optical waveguide and the first  
4 transverse-coupling segment of the modulator optical waveguide being adapted for  
5 dividing, via transverse optical coupling therebetween, the received optical signal power  
6 into a modulator waveguide fraction and a transmission waveguide fraction, and for  
7 transmitting the fractions to the respective intermediate waveguide segments,  
8 the second transverse-coupling segment of the transmission optical waveguide and the  
9 second transverse-coupling segment of the modulator optical waveguide being adapted  
10 for receiving, and recombining via transverse optical coupling the modulator waveguide  
11 fraction and the transmission waveguide fraction, and transmitting the recombined  
12 fractions to the optical signal transmission system,  
13 the multi-layer waveguide structure being adapted so that varying the control signal applied  
14 to the intermediate waveguide segment results in a varying level of transmission of the  
15 recombined fractions to the optical signal transmission system,  
16 the transmission optical waveguide being a low-index planar lightwave transmission optical  
17 waveguide, the planar lightwave transmission optical waveguide being adapted for  
18 transverse-coupling.

19 101. An optical switch, comprising:  
20 a first optical waveguide, the first optical waveguide including an input segment, a  
21 transverse-coupling segment, and an output segment; and  
22 a second optical waveguide, the second optical waveguide including an input segment, a  
23 transverse-coupling segment, and an output segment,  
24 the first and second optical waveguides being transverse-coupled at the respective  
25 transverse-coupling segments thereof,  
26 the input segments of the first and second optical waveguides each being adapted for  
27 receiving optical signal power from an optical signal transmission system and  
28 transmitting received optical signal power to the respective transverse-coupling  
29 segment,

1 the output segments of the first and second optical waveguides each being adapted for  
2 receiving optical signal power from the respective transverse-coupling segments and  
3 transmitting the optical signal power to the optical signal transmission system,  
4 the first and second optical waveguides each comprising a laterally-confined multi-layer  
5 dispersion-engineered waveguide structure, the multi-layer waveguide structure  
6 including at least one multi-layer reflector stack and at least one active layer, the active  
7 layer being adapted for exhibiting at least one of varying optical loss and varying  
8 modal-index in response to an applied control signal,  
9 the multi-layer waveguide structure being adapted so that varying the control signal applied  
10 to at least one of the transverse-coupling segments results in optical signal power  
11 transfer between the first and second transmission optical waveguides.

12 102. The optical switch of Claim 101, the active layer including at least one electro-active layer,  
13 the electro-active layer including at least one of an electro-optic layer and an electro-  
14 absorptive layer, the transverse coupling segment of at least one of the optical waveguides  
15 including a pair of electrical contacts with the electro-active layer therebetween, the control  
16 signal being an electrical control signal applied through the electrical contacts.

17 103. The optical switch of Claim 101, the active layer including at least one non-linear optical  
18 layer, the control signal being an optical control signal applied to a portion of the non-linear-  
19 optical layer in the transverse-coupling segment of at least one of the optical waveguides.

20 104. The optical switch of Claim 101, the multi-layer waveguide structure including a single  
21 multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for  
22 guiding a surface-guided optical mode.

23 105. The optical switch of Claim 101, the multi-layer waveguide structure including two multi-  
24 layer reflector stacks and a core layer therebetween, the multi-layer waveguide structure  
25 being thereby adapted for guiding an optical mode along the core layer.

26 106. The optical switch of Claim 101, the input segments of the first and second optical  
27 waveguides being adapted for receiving optical signal power from the optical signal  
28 transmission system by end-coupling, the output segments of the first and second optical

1 waveguides being adapted for transmitting optical signal power to the optical signal  
2 transmission system by end-coupling.

3 107. An optical switch, comprising:

4 a first optical waveguide, the first optical waveguide including an input segment, a  
5 transverse-coupling segment, and an output segment; and

6 a second optical waveguide, the second optical waveguide including an input segment, a  
7 transverse-coupling segment, and an output segment,

8 the first and second optical waveguides being transverse-coupled at the respective  
9 transverse-coupling segments thereof,

10 the input segments of the first and second optical waveguides each being adapted for  
11 receiving optical signal power from an optical signal transmission system and  
12 transmitting received optical signal power to the respective transverse-coupling  
13 segment,

14 the output segments of the first and second optical waveguides each being adapted for  
15 receiving optical signal power from the respective transverse-coupling segments and  
16 transmitting the optical signal power to the optical signal transmission system,

17 the first and second optical waveguides each comprising a laterally-confined multi-layer  
18 dispersion-engineered waveguide structure, the multi-layer waveguide structure  
19 including at least one multi-layer reflector stack and at least one active layer, the active  
20 layer being adapted for exhibiting at least one of varying optical loss and varying  
21 modal-index in response to an applied control signal,

22 the multi-layer waveguide structure being adapted so that varying the control signal applied  
23 to at least one of the transverse-coupling segments results in optical signal power  
24 transfer between the first and second transmission optical waveguides,

25 the input segments of the first and second optical waveguides being adapted for receiving  
26 optical signal power from the optical signal transmission system by transverse-coupling  
27 to a transmission optical waveguide, the output segments of the first and second optical  
28 waveguides being adapted for transmitting optical signal power to the optical signal  
29 transmission system by transverse coupling to a transmission optical waveguide.

1 108. The optical switch of Claim 107, the multi-layer waveguide structure including a high-index  
2 material.

3 109. The optical switch of Claim 107, the transmission optical waveguide being a low-index  
4 transmission optical waveguide, the low-index waveguide being adapted for transverse-  
5 coupling.

6 110. The optical switch of Claim 107, the transmission optical waveguide being a transmission  
7 fiber-optic waveguide, the transmission fiber-optic waveguide being adapted for transverse-  
8 coupling.

9 111. An optical switch, comprising:

10 a first optical waveguide, the first optical waveguide including an input segment, a  
11 transverse-coupling segment, and an output segment; and

12 a second optical waveguide, the second optical waveguide including an input segment, a  
13 transverse-coupling segment, and an output segment,

14 the first and second optical waveguides being transverse-coupled at the respective  
15 transverse-coupling segments thereof,

16 the input segments of the first and second optical waveguides each being adapted for  
17 receiving optical signal power from an optical signal transmission system and  
18 transmitting received optical signal power to the respective transverse-coupling  
19 segment,

20 the output segments of the first and second optical waveguides each being adapted for  
21 receiving optical signal power from the respective transverse-coupling segments and  
22 transmitting the optical signal power to the optical signal transmission system,

23 the first and second optical waveguides each comprising a laterally-confined multi-layer  
24 dispersion-engineered waveguide structure, the multi-layer waveguide structure  
25 including at least one multi-layer reflector stack and at least one active layer, the active  
26 layer being adapted for exhibiting at least one of varying optical loss and varying  
27 modal-index in response to an applied control signal,

28 the multi-layer waveguide structure being adapted so that varying the control signal applied  
29 to at least one of the transverse-coupling segments results in optical signal power  
30 transfer between the first and second transmission optical waveguides,

1 the input segments of the first and second optical waveguides being adapted for receiving  
2 optical signal power from the optical signal transmission system by transverse-coupling  
3 to a transmission optical waveguide, the output segments of the first and second optical  
4 waveguides being adapted for transmitting optical signal power to the optical signal  
5 transmission system by transverse coupling to a transmission optical waveguide,  
6 the transmission optical waveguide being a transmission fiber-optic waveguide including a  
7 fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-  
8 coupling.

9 112. An optical switch, comprising:

10 a first optical waveguide, the first optical waveguide including an input segment, a  
11 transverse-coupling segment, and an output segment; and  
12 a second optical waveguide, the second optical waveguide including an input segment, a  
13 transverse-coupling segment, and an output segment,  
14 the first and second optical waveguides being transverse-coupled at the respective  
15 transverse-coupling segments thereof,  
16 the input segments of the first and second optical waveguides each being adapted for  
17 receiving optical signal power from an optical signal transmission system and  
18 transmitting received optical signal power to the respective transverse-coupling  
19 segment,  
20 the output segments of the first and second optical waveguides each being adapted for  
21 receiving optical signal power from the respective transverse-coupling segments and  
22 transmitting the optical signal power to the optical signal transmission system,  
23 the first and second optical waveguides each comprising a laterally-confined multi-layer  
24 dispersion-engineered waveguide structure, the multi-layer waveguide structure  
25 including at least one multi-layer reflector stack and at least one active layer, the active  
26 layer being adapted for exhibiting at least one of varying optical loss and varying  
27 modal-index in response to an applied control signal,  
28 the multi-layer waveguide structure being adapted so that varying the control signal applied  
29 to at least one of the transverse-coupling segments results in optical signal power  
30 transfer between the first and second transmission optical waveguides,

1 the input segments of the first and second optical waveguides being adapted for receiving  
2 optical signal power from the optical signal transmission system by transverse-coupling  
3 to a transmission optical waveguide, the output segments of the first and second optical  
4 waveguides being adapted for transmitting optical signal power to the optical signal  
5 transmission system by transverse coupling to a transmission optical waveguide,  
6 the transmission optical waveguide being a low-index planar lightwave transmission optical  
7 waveguide, the planar lightwave transmission optical waveguide being adapted for  
8 transverse-coupling.

9 113. A resonant optical device, comprising:

10 a transmission optical waveguide; and

11 an optical resonator transverse-coupled to the transmission optical waveguide so as to enable  
12 optical signal power transfer therebetween,

13 the transmission optical waveguide being adapted for at least one of receiving optical signal  
14 power from an optical signal transmission system and transmitting optical signal power  
15 to the optical signal transmission system,

16 the optical resonator including a laterally-confined multi-layer dispersion-engineered  
17 waveguide structure, the multi-layer waveguide structure including at least one multi-  
18 layer reflector stack and at least one active layer, the active layer being adapted for  
19 exhibiting at least one of varying optical loss and varying modal-index in response to an  
20 applied control signal,

21 the optical resonator being transverse-coupled to the transmission optical waveguide through  
22 the multi-layer waveguide structure, the multi-layer waveguide structure being adapted  
23 for enabling control, by application of a control signal, of at least one of optical signal  
24 power transfer between the transmission optical waveguide and the optical resonator, a  
25 resonant frequency of the optical resonator, and optical loss of the optical resonator,  
26 thereby further enabling modulation of transmission of optical signal power through the  
27 transmission optical waveguide when the optical signal is substantially resonant with  
28 the optical resonator.

29 114. The optical modulator of Claim 113, the active layer including at least one electro-active  
30 layer, the electro-active layer including at least one of an electro-optic layer and an electro-

1 absorptive layer, the optical resonator including a pair of electrical contacts with at least a  
2 portion of the electro-active layer therebetween, the control signal being an electrical control  
3 signal applied through the electrical contacts.

4 115. The optical modulator of Claim 113, the active layer including at least one non-linear optical  
5 layer, the control signal being an optical control signal applied to the non-linear-optical layer  
6 in at least a portion of the optical resonator.

7 116. The optical modulator of Claim 113, the multi-layer waveguide structure including a single  
8 multi-layer waveguide stack, the multi-layer waveguide structure being thereby adapted for  
9 guiding a surface-guided optical mode.

10 117. The optical modulator of Claim 113, the multi-layer waveguide structure including two  
11 multi-layer reflector stacks and a core layer therebetween, the multi-layer waveguide  
12 structure being thereby adapted for guiding an optical mode along the core layer.

13 118. The optical modulator of Claim 113, the optical resonator and the transmission optical  
14 waveguide being passively substantially modal-index-matched at respective transverse-  
15 coupling segments thereof.

16 119. The optical modulator of Claim 113, the optical resonator and the transmission optical  
17 waveguide being actively substantially modal-index-matched at respective transverse-  
18 coupling segments thereof by applying a control signal to the active layer in the transverse-  
19 coupling segment of the optical resonator.

20 120. The optical modulator of Claim 113, the multi-layer waveguide structure including a high-  
21 index material.

22 121. The optical modulator of Claim 113, the transmission optical waveguide being a low-index  
23 transmission optical waveguide, the low-index waveguide being adapted for transverse-  
24 coupling.

25 122. The optical modulator of Claim 113, the transmission optical waveguide being a  
26 transmission fiber-optic waveguide, the transmission fiber-optic waveguide being adapted  
27 for transverse-coupling.

28 123. A resonant optical device, comprising:

1 a transmission optical waveguide; and  
2 an optical resonator transverse-coupled to the transmission optical waveguide so as to enable  
3 optical signal power transfer therebetween,  
4 the transmission optical waveguide being adapted for at least one of receiving optical signal  
5 power from an optical signal transmission system and transmitting optical signal power  
6 to the optical signal transmission system,  
7 the optical resonator including a laterally-confined multi-layer dispersion-engineered  
8 waveguide structure, the multi-layer waveguide structure including at least one multi-  
9 layer reflector stack and at least one active layer, the active layer being adapted for  
10 exhibiting at least one of varying optical loss and varying modal-index in response to an  
11 applied control signal,  
12 the optical resonator being transverse-coupled to the transmission optical waveguide through  
13 the multi-layer waveguide structure, the multi-layer waveguide structure being adapted  
14 for enabling control, by application of a control signal, of at least one of optical signal  
15 power transfer between the transmission optical waveguide and the optical resonator, a  
16 resonant frequency of the optical resonator, and optical loss of the optical resonator,  
17 thereby further enabling modulation of transmission of optical signal power through the  
18 transmission optical waveguide when the optical signal is substantially resonant with  
19 the optical resonator,  
20 the transmission optical waveguide being a transmission fiber-optic waveguide including a  
21 fiber-optic-taper segment, the fiber-optic-taper segment being adapted for transverse-  
22 coupling.

23 124. A resonant optical device, comprising:

24 a transmission optical waveguide; and  
25 an optical resonator transverse-coupled to the transmission optical waveguide so as to enable  
26 optical signal power transfer therebetween,  
27 the transmission optical waveguide being adapted for at least one of receiving optical signal  
28 power from an optical signal transmission system and transmitting optical signal power  
29 to the optical signal transmission system,

1 the optical resonator including a laterally-confined multi-layer dispersion-engineered  
2 waveguide structure, the multi-layer waveguide structure including at least one multi-  
3 layer reflector stack and at least one active layer, the active layer being adapted for  
4 exhibiting at least one of varying optical loss and varying modal-index in response to an  
5 applied control signal,

6 the optical resonator being transverse-coupled to the transmission optical waveguide through  
7 the multi-layer waveguide structure, the multi-layer waveguide structure being adapted  
8 for enabling control, by application of a control signal, of at least one of optical signal  
9 power transfer between the transmission optical waveguide and the optical resonator, a  
10 resonant frequency of the optical resonator, and optical loss of the optical resonator,  
11 thereby further enabling modulation of transmission of optical signal power through the  
12 transmission optical waveguide when the optical signal is substantially resonant with  
13 the optical resonator,

14 the transmission optical waveguide being a low-index planar lightwave transmission optical  
15 waveguide, the planar lightwave transmission optical waveguide being adapted for  
16 transverse-coupling.

17 125. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
18 waveguide structure, comprising the steps of:

19 depositing a layer structure on a substrate, the layer structure including a multi-layer  
20 reflector stack and an active layer; and

21 spatially-selectively processing at least a portion of at least one of the multi-layer reflector  
22 stack and the active layer so as to provide lateral confinement for a guided optical  
23 mode.

24 126. The method of Claim 125, further including the step of processing at least one side of the  
25 multi-layer waveguide structure to provide at least one layer of the multi-layer waveguide  
26 structure with at least one lateral lower-index portion.

27 127. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
28 waveguide structure, comprising the steps of:

29 depositing a layer structure on a substrate, the layer structure including a multi-layer  
30 reflector stack and an active layer;

1 spatially-selectively processing at least a portion of at least one of the multi-layer reflector  
2 stack and the active layer so as to provide lateral confinement for a guided optical  
3 mode; and

4 processing at least one side of the multi-layer waveguide structure to provide at least one  
5 layer of the multi-layer waveguide structure with at least one lateral lower-index  
6 portion,

7 the lateral lower-index portion being provided by oxidation of a lateral portion of the layer.

8 128. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
9 waveguide structure, comprising the steps of:

10 depositing a first layer structure on a first substrate, the first layer structure including a  
11 multi-layer reflector stack;

12 depositing a second layer structure on a second substrate, the second layer structure  
13 including an active layer;

14 securedly positioning the second substrate relative to the first substrate so as to substantially  
15 eliminate voids between the first and second layer structures;

16 removing the second substrate while leaving the at least a portion of the second layer  
17 structure; and

18 spatially-selectively processing at least a portion of at least one of the first and second layer  
19 structures so as to provide lateral confinement for a guided optical mode.

20 129. The method of Claim 128, further including the step of processing at least one side of the  
21 multi-layer waveguide structure to provide at least one layer thereof with at least one lateral  
22 lower-index portion thereof.

23 130. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
24 waveguide structure, comprising the steps of:

25 depositing a first layer structure on a first substrate, the first layer structure including a  
26 multi-layer reflector stack;

27 depositing a second layer structure on a second substrate, the second layer structure  
28 including an active layer;

29 securedly positioning the second substrate relative to the first substrate so as to substantially  
30 eliminate voids between the first and second layer structures;

1 removing the second substrate while leaving the at least a portion of the second layer  
2 structure;  
3 spatially-selectively processing at least a portion of at least one of the first and second layer  
4 structures so as to provide lateral confinement for a guided optical mode; and  
5 processing at least one side of the multi-layer waveguide structure to provide at least one  
6 layer thereof with at least one lateral lower-index portion thereof,  
7 the lateral lower-index portion being provided by oxidation of a portion of the layer.

8 131. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
9 waveguide structure, comprising the steps of:

10 depositing a layer structure on a substrate, the layer structure including a first multi-layer  
11 reflector stack, a second multi-layer reflector stack, a core layer therebetween, and an  
12 active layer; and  
13 spatially-selectively processing at least one of the first and second multi-layer-reflector  
14 stacks, the core layer, and the active layer, thereby providing lateral confinement for a  
15 guided optical mode.

16 132. The method of Claim 131, further including the step of processing at least one side of the  
17 multi-layer waveguide structure to provide at least one layer thereof with at least one lateral  
18 lower-index portion thereof.

19 133. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
20 waveguide structure, comprising the steps of:

21 depositing a layer structure on a substrate, the layer structure including a first multi-layer  
22 reflector stack, a second multi-layer reflector stack, a core layer therebetween, and an  
23 active layer;  
24 spatially-selectively processing at least one of the first and second multi-layer-reflector  
25 stacks, the core layer, and the active layer, thereby providing lateral confinement for a  
26 guided optical mode; and  
27 processing at least one side of the multi-layer waveguide structure to provide at least one  
28 layer thereof with at least one lateral lower-index portion thereof,  
29 the lateral lower-index portion being provided by oxidation of a portion of the layer.

- 1 134. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
2 waveguide structure, comprising the steps of:  
3 depositing a first layer structure on a first substrate, the first layer structure including a first  
4 multi-layer reflector stack;  
5 depositing a second layer structure on a second substrate, the second layer structure  
6 including a second multi-layer reflector stack, at least one of the first and second layer  
7 structures including a core layer, at least one of the first and second layer structures  
8 including an active layer;  
9 securedly positioning the second substrate relative to the first substrate so as to substantially  
10 eliminate voids between the first and second layer structures and so as to position the  
11 core layer between the first and second multi-layer reflector stacks;  
12 removing one of the first and second substrates while leaving at least a portion of each of the  
13 first multi-layer reflector stack, the core, the second multi-layer reflector stack, and the  
14 active layer; and  
15 spatially-selectively processing at least one of the first multi-layer reflector stack, the core  
16 layer, the second multi-layer reflector stack, and the active layer, thereby providing  
17 lateral confinement for a guided optical mode.
- 18 135. The method of Claim 134, further including the step of processing at least one side of the  
19 multi-layer waveguide structure to provide at least one layer thereof with at least one lateral  
20 lower-index portion thereof.
- 21 136. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
22 waveguide structure, comprising the steps of:  
23 depositing a first layer structure on a first substrate, the first layer structure including a first  
24 multi-layer reflector stack;  
25 depositing a second layer structure on a second substrate, the second layer structure  
26 including a second multi-layer reflector stack, at least one of the first and second layer  
27 structures including a core layer, at least one of the first and second layer structures  
28 including an active layer;

1       securedly positioning the second substrate relative to the first substrate so as to substantially  
2       eliminate voids between the first and second layer structures and so as to position the  
3       core layer between the first and second multi-layer reflector stacks;  
4       removing one of the first and second substrates while leaving at least a portion of each of the  
5       first multi-layer reflector stack, the core, the second multi-layer reflector stack, and the  
6       active layer;  
7       spatially-selectively processing at least one of the first multi-layer reflector stack, the core  
8       layer, the second multi-layer reflector stack, and the active layer, thereby providing  
9       lateral confinement for a guided optical mode; and  
10      processing at least one side of the multi-layer waveguide structure to provide at least one  
11      layer thereof with at least one lateral lower-index portion thereof,  
12      the lateral lower-index portion being provided by oxidation of a portion of the layer.

13 137. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
14 waveguide structure on a substrate, comprising the steps of:

15       depositing a first layer structure on a first substrate, the first layer structure including a first  
16       multi-layer reflector stack;

17       depositing a second layer structure on a second substrate, the second layer structure  
18       including a second multi-layer reflector stack;

19       depositing third layer structure on a third substrate, the third layer structure including an  
20       active layer, at least one of the first, second, and third layer structures including a core  
21       layer;

22       securedly positioning the third substrate relative to the first substrate so as to substantially  
23       eliminate voids between the first and third layer structures;

24       removing the third substrate while leaving at least a portion of the active layer;

25       securedly positioning the second substrate relative to the first substrate so as to substantially  
26       eliminate voids between the second and third layer structures and so as to position the  
27       core layer between the first and second multi-layer reflector stacks;

28       removing the second substrate while leaving at least a portion of the second multi-layer  
29       reflector stack; and

1 spatially-selectively processing at least one of the first multi-layer reflector stack, the core  
2 layer, the second multi-layer reflector stack, and the active layer, thereby providing  
3 lateral confinement for a guided optical mode.

4 138. The method of Claim 137, further including the step of processing at least one side of the  
5 multi-layer waveguide structure to provide at least one layer thereof with at least one lateral  
6 lower-index portion thereof.

7 139. A method for fabricating a multi-layer laterally-confined dispersion-engineered optical  
8 waveguide structure on a substrate, comprising the steps of:  
9 depositing a first layer structure on a first substrate, the first layer structure including a first  
10 multi-layer reflector stack;  
11 depositing a second layer structure on a second substrate, the second layer structure  
12 including a second multi-layer reflector stack;  
13 depositing third layer structure on a third substrate, the third layer structure including an  
14 active layer, at least one of the first, second, and third layer structures including a core  
15 layer;  
16 securedly positioning the third substrate relative to the first substrate so as to substantially  
17 eliminate voids between the first and third layer structures;  
18 removing the third substrate while leaving at least a portion of the active layer;  
19 securedly positioning the second substrate relative to the first substrate so as to substantially  
20 eliminate voids between the second and third layer structures and so as to position the  
21 core layer between the first and second multi-layer reflector stacks;  
22 removing the second substrate while leaving at least a portion of the second multi-layer  
23 reflector stack;  
24 spatially-selectively processing at least one of the first multi-layer reflector stack, the core  
25 layer, the second multi-layer reflector stack, and the active layer, thereby providing  
26 lateral confinement for a guided optical mode; and  
27 processing at least one side of the multi-layer waveguide structure to provide at least one  
28 layer thereof with at least one lateral lower-index portion thereof,  
29 the lateral lower-index portion being provided by oxidation of a portion of the layer.  
30